CONNECTOR ENABLING SECURE RETENTION OF CONTACTS RELATIVE TO INSULATOR

Background of the Invention:

The present invention relates to a connector suitable for electrically and mechanically connecting between devices mounted on a vehicle or the like that is subjected to vibration.

JP-A-H07-37639 discloses one example of a connector of this type, wherein the connector comprises an insulator of a box shape, conductive contacts disposed in the insulator, and a retainer for preventing the contacts from coming off the insulator. Each contact is connected to one end portion of a cable and inserted into the insulator. The retainer is inserted into the insulator so as to engage with the contacts and the insulator. As a result, the contacts are securely retained relative to the insulator, and therefore, even if the connector is subjected to vibration, the contacts are prevented from coming off.

However, if the retainer is subjected to unexpected occurrence of disadvantage such as deformation, distortion, or breakage, the power of the retainer for retaining the contacts is lowered. In an extreme case, the retainer loses its retaining power so that the contacts may come off the insulator. There is also possibility that the foregoing disadvantage of the retainer may occur when handling the retainer upon assembling the connector.

Summary of the Invention:

It is therefore an object of the present invention to provide a connector that has been improved to ensure secure retention of contacts relative to an insulator.

It is another object of the present invention to provide a connector that can prevent unexpected excessive deformation or distortion to improve rigidity, that is easy in handling upon operation, and that can improve the retaining power for retaining contacts.

Other objects of the present invention will become clear as the description proceeds.

According to an aspect of the present invention, there is provided a connector which comprises an insulator having a contact receiving portion and a retainer receiving portion that communicate with each other, a conductive contact inserted into the contact receiving portion from a first direction, and a retainer inserted into the retainer receiving portion from the first direction for preventing the contact from coming off in a direction opposite to the first direction, the retainer comprising a body portion and an elastic piece that is elastically deformable and joined to the body portion, the body portion having an excessive deformation preventing portion for preventing excessive deformation of the elastic piece toward the body portion, the elastic piece having a specific lock portion, the insulator having a specific lock receiving portion for locking the specific lock portion when the retainer is inserted to a predetermined position of the retainer receiving portion.

Brief Description of the Drawings:

Fig. 1 is a perspective view showing a connector according to a preferred embodiment of the present invention in the state where cables are connected thereto;

Fig. 2 is a perspective view for explaining a first process of an operation for assembling the connector of Fig. 1;

Fig. 3 is a perspective view for explaining a second process of the operation for assembling the connector of Fig. 1;

Fig. 4 is a front view of a retainer used in the connector of Fig. 1;

Fig. 5 is a plan view of the retainer used in the connector of Fig. 1;

Fig. 6 is a bottom view of the retainer used in the connector of Fig. 1;

Fig. 7 is an enlarged sectional view taken along a line VII-VII in Fig. 1; and

Fig. 8 is a sectional view taken along a line VIII-VIII in Fig. 7.

Description of the Preferred Embodiment:

Referring to Figs. 1 to 3, description will be given about a connector according to a preferred embodiment of the present invention.

The shown connector comprises a housing or an insulator 11, a plurality of (three in this embodiment) conductive contacts 13 that are inserted into the insulator 11, and a retainer 15 for preventing the contacts 13 from coming off the insulator 11. The insulator 11 is formed with a plurality of (three in this embodiment) contact receiving portions 11a, and a retainer receiving portion 11b communicating with the contact receiving portions 11a. The contact receiving portions 11a each extend in a first direction A1, and are arrayed in a second direction A2 perpendicular to the first direction A1. The retainer receiving portion 11b is adjacent to the contact receiving portions 11a in a third direction A3 perpendicular to the first and second directions A1 and A2.

Each of the contacts 13 is electrically and mechanically connected to one end portion of a cable 17 and inserted into the corresponding contact receiving portion 11a from the first direction A1 so as to be retained in the insulator 11. Each contact 13 has a contact portion 13a for contact with a counterpart contact of a counterpart connector (not shown).

The retainer 15 serves to prevent the contacts 13 inserted in the insulator 11 from coming off in a direction opposite to the first direction A1. After insertion of the contacts 13, the retainer 15 is inserted into the retainer receiving portion 11b of the insulator 11 from the same direction as the contacts

13.

As will be clear from later description, the retainer 15 mounted in the insulator 11 engages with the contacts 13 and the insulator 11 to thereby have the contacts 13 securely retained relative to the insulator 11. Therefore, even if the connector is subjected to vibration, the contacts 13 are prevented from coming off the insulator 11.

Referring to Figs. 4 to 6, the retainer 15 will be described.

The retainer 15 is a secondary production component that is separate from the insulator 11, and comprises a body portion 15a of substantially a plate shape, and a pair of elastic pieces 15b on both side surfaces of the body portion 15a. Each of the elastic pieces 15b has a belt shape extending substantially along the first direction A1, and has its both ends unitarily joined to the side surface of the body portion 15a. The body portion 15a and the elastic pieces 15b may be made of, for example, the same resin material.

Each elastic piece 15b can be deformed toward the side surface of the body portion 15a and further returned to the initial state in the second directions A2. That is, each elastic piece 15b has a spring function. Further, each elastic piece 15b is formed with a specific lock portion 15c projected outward at an intermediate portion thereof.

The body portion 15a is formed on the side surfaces thereof with a pair of excessive deformation preventing portions 15d each confronting the elastic piece 15b in the second direction A2. Each of the excessive deformation preventing portions 15d serves to prevent the corresponding elastic piece 15b from being excessively deformed. Further, the body portion 15a has one surface in the third direction A3 on which a particular lock portion 15e is projected for locking to the insulator 11 within the retainer receiving portion 11b.

Referring also to Figs. 7 and 8, description will be given about a relationship among the insulator 11, the contacts 13, and the retainer 15.

An inner wall surface of the retainer receiving portion 11b of the insulator 11 is formed with specific lock receiving portions 11c and a particular lock receiving portion 11e. Each of the specific lock receiving portions 11c is a surface defining a through hole piercing a wall portion of the insulator 11 in the second direction A2 and, when the retainer 15 is inserted to a predetermined position, it locks the corresponding specific lock portion 15c. The particular lock receiving portion 11e is a surface defining a through hole piercing a wall portion of the insulator 11 in the third direction A3 and, when the retainer 15 is inserted to the predetermined position, it locks the particular lock portion 15e.

The insulator 11 has plural deformable portions 11f placed adjacent to the contact receiving portions 11a, respectively. The deformable portions 11f are elastically deformable in the third direction A3. Plural or three protrusions 11g are formed integral with the deformable portions 11f to protrude towards the contact receiving portions 11a, respectively.

The contacts 13 have engaging holes 13c which are for receiving therein the protrusions 11g, respectively. In a state where the protrusions 11g are inserted in the engaging holes 13c, the contacts 13 are locked relative to the insulator 11 in the first direction A1 and an opposite direction opposite to the first direction A1.

When the contacts 13 are inserted into the contact receiving portions 11a, the protrusions 11g are pushed by the contacts 13. As a result, the deformable portions 11f are temporally and elastically deformed by the contacts 13 to apart from the contact receiving portions 11a. When the protrusions 11g are inserted in the engaging holes 13c, the deformable portions 11f are restored in the original state. Therefore, the contacts 13 are directly locked against the insulator 11 as described above. In this event, a combination of corresponding ones of the protrusions 11g and the engaging holes 13c will be referred to as a primary lock mechanism for directly locking each of the contacts 13 with said

insulator in the first direction A1.

It is possible to release a lock of the primary lock mechanism by inserting an operating jig (not shown) between the contacts 13 and the deformable portions 11f through a wedge-shaped gap 13. More particularly, when the operating jig is inserted between the contacts 13 and the deformable portions 11f, the protrusions 11g are removed from the engaging holes 13c. In this connection, the deformable portions 11f may be formed integral one another.

Furthermore, the contacts 13 have shoulder portions 13b engaging with an insert end 15f of the retainer 15 to be thereby locked within the contact receiving portions 11a. Therefore, the contacts 13 are prevented by the retainer 15 from being pulled out in the opposite direction that is opposite to the first direction A1. In this event, a combination of each of the shoulder portions 13b and the insert end 15f will be referred to as a secondary lock mechanism for indirectly locking each of the contacts 13 with the insulator 11 through the retainer 15 in the first direction A1.

Now, description will be given about an operation of assembling the connector of Fig. 1.

At the outset, in a first process of the assembling operation, as shown in Fig. 2, each contact 13 connected with the cable 17 is inserted into the contact receiving portion 11a of the insulator 11 from the first direction A1.

Then, in a second process of the assembling operation, as shown in Fig. 3, the retainer 15 is inserted into the retainer receiving portion 11b from the first direction A1. When the retainer 15 is inserted into the retainer receiving portion 11b, the elastic pieces 15b are pressed toward the body portion 15a by the inner wall surface of the retainer receiving portion 11b to be thereby deformed.

Then, when the retainer 15 is inserted to the predetermined position of the retainer receiving portion 11b as shown in Figs. 1 and 7, the specific lock portions 15c enter the specific lock receiving portions 11c, and the particular lock portion 15e enters the particular lock receiving portion 11e so that the retainer 15 is locked within the retainer receiving portion 11b. Further, since the shoulder portions 13b are engaged with the insert end 15f of the retainer 15, the contacts 13 are locked within the contact receiving portions 11a. Therefore, the contacts 13 are prevented by the retainer 15 from being pulled out in a direction opposite to the first direction A1.

As described above, the contacts 13 are prevented from coming off, and the secure retention of the contacts 13 is achieved. Further, by means of the contact of each elastic piece 15b with the corresponding excessive deformation preventing portion 15d, excessive deformation of the elastic piece 15b in the deforming direction is prevented upon inserting the retainer 15 to the predetermined position of the retainer receiving portion 11b.

The retainer 15 can be removed from the insulator 11. Specifically, the retainer 15 can be detached by pushing the elastic pieces 15b toward the side surfaces of the body portion 15a using a tool (not shown) or the like in the state shown in Figs. 7 and 8 to thereby release the locking between the specific lock portions 15c and the specific lock receiving portions 11c, further releasing the locking between the particular lock portion 15e and the particular lock receiving portion 11e thereupon, and then pulling out the retainer 15 from the insulator 11. In this event, each elastic piece 15b is deformable until it is brought into contact with the corresponding excessive deformation preventing portion 15d, and therefore, the lock releasing operation can be carried out while preventing excessive deformation exceeding it.

While the present invention has thus far been described in connection with a single embodiment thereof, it will readily be possible for those skilled in

the art to put this invention into practice in various other manners. For example, a recess or a groove can form each of the lock receiving portions.